THE IMPLICATION OF BODY WEIGHT TO REPRODUCTIVE STRATEGY AMONG YOUNG ADULT FEMALE WHITE-TAILED DEER.[1]

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ABSTRACT: Field-dressed weights of white-tailed deer (Odocoileus virginianus) were obtained during autumn 1975-1985 from two dissimilar habitats - a late seral coniferous forest in northwestern Montana and riparian bottomlands along a major river in extreme eastern Montana. Average age-specific weights of field-dressed males and females from the Yellowstone River were 91% and 87%, respectively, of deer from the Swan Valley. The greatest differences in weight between the 2 areas occurred in females of age classes 2 and 3. This appeared related to differences in reproductive success between the respective populations. Biological and environmental characteristics of those habitats offered some explanation for these phenomena.

INTRODUCTION

Habitat quality, body size or weight, and reproductive success are commonly held to be directly related in deer. Within the same region, comparable age classes of white-tailed deer will weigh less on poor-quality range (Severinghaus 1979). Similarly, body weight has been shown to be directly correlated with, and may be used to predict, reproductive rates in female whitetails (Sauer 1984). As generally interpreted, high quality habitats are equated with high mean age-specific body weights and high reproductive rates and success.

Our recent analyses of biological parameters of two populations of white-tailed deer occupying dissimilar habitats in the northern Rocky Mountains and Great Plains of Montana suggest that this traditional interpretation may need further qualification. Here, we present findings concerning differences in patterns of growth and age-specific weights in relation to reproduction among those whitetails and discuss implications to understanding species population biology and ecology.

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The Swan Valley in northwestern Montana lies between two ranges of the northern Rocky Mountains (Mundinger 1981). Vegetation consists of a late seral coniferous forest, and timber production is the principal commercial land use. The continental climate includes winter-like conditions typically extending from mid-November through late March with continuous snow cover. Snowfall is relatively heavy (382-441 cm), but temperatures seldom drop below -12 C.

The lower Yellowstone River in eastern Montana dissects mixed-grass prairie of the northern Great Plains. Riparian habitats on the floodplain, consisting of deciduous tree and shrub communities, are interspersed with agricultural crop and hay lands (Herriges 1986). Irrigated farming and livestock grazing are the principal commercial land uses. The climate of eastern Montana is semiarid with highly variable annual precipitation (ave. 35 cm) and large daily and seasonal fluctuations in temperature. Winterlike conditions typically extend from late November through early March. January temperatures often drop below -14 C. Snow accumulations rarely exceed 38 cm and are typically not continuous through winter.

Deer in the Swan Valley are distributed largely within the mature forest where they migrate between relatively small seasonal home ranges (< 80 ha) (Mundinger 1981). Conversely, deer on the lower Yellowstone were nonmigratory with regard to season, and the most extensive movements were from riparian tree and shrub communities used during daytime to agricultural fields to feed at night (Compton 1986, Herriges 1986). Winter diets consist almost entirely of browse and arboreal lichens in the Swan Valley (Mundinger 1981), but include nearly 50% agricultural crops on the lower Yellowstone (Dusek 1984).

WEIGHT AND GROWTH PATTERNS

Field-dressed weights were obtained for 869 deer from the Swan Valley during the 1975-1983 hunting seasons and for 129 deer from the lower Yellowstone during 1980-1985. Ages were assigned by tooth replacement and wear (Severinghaus 1949) and cementum analysis (Gilbert 1966). Data from females 4 years and older were combined within populations because of small samples and no apparent differences among older does. Weights of males up to 4 years were used because no older males were examined on the lower Yellowstone.

Field-dressed deer from the Swan Valley were heavier than deer from the lower Yellowstone (Fig. 1). Average fall weights across age classes from the Yellowstone were 91% (range 85-98%) and 87% (range 81-92%) of those from the Swan for males and females, respectively. Mean weights of females of ages 0.5, 1, 2, and 3 years from the Yellowstone were 90%, 92%, 82% and 81% of the respective age classes of females from the Swan.

Apparent increases in weight occurred through 4 years for

males from both areas and through 3 years for females from the Swan. The greatest difference between age classes occurred between fawns and yearlings (Fig. 1). A similar increase in weight from fawns to yearlings was observed among females from the Yellowstone, but no increase in weight occurred between yearlings and 2 year-olds. Only a slight increase was evident between 2 and 3 year-olds, and growth may have continued at least through an age of 4 years. Although few 2 year-old females were weighed from the Yellowstone during fall, a similar relationship existed between live weights of yearling and 2 year-old females captured during winter and early spring (Dusek, unpubl. data).

RELATIONSHIP BETWEEN GROWTH PATTERNS AND REPRODUCTION

Knowlton et al. (1980) reported that white-tailed deer continue to gain weight through 4 years for females and 5-6 years for males. Similar patterns were observed for males from both Montana areas. Weight and growth patterns of deer in the 2 habitats suggested more productive range conditions in the Swan, although other data, including reproductive patterns, suggested the opposite. Consistently heavier age-specific weights among Swan Valley deer probably reflected genetic and distributional differences between two subspecies (Baker 1984).

Whitetails in the Swan Valley typically produce only in alternate years despite a pregnancy rate of 96% and a fetal rate of 150/100 among yearling and older females (Mundinger 1981). Less than half of the 2 year-old females successfully reared fawns. About 59% of the reproductive potential among all parous females was lost to neonatal mortality. This was most pronounced among does less than 5 years old. Fawn losses were attributed to nutritional stress during the previous winter.

The pregnancy rate among Yellowstone females (93%) was similar to that of the Swan Valley, but the fetal rate (176/100) more closely approached the biotic potential. Lower post partum fawn mortality (37%) varied directly with adult female density (Dusek, unpubl. data). About two-thirds of the 2 year-old females on the lower Yellowstone reared fawns to autumn. Condition indexes indicated no apparent nutritional stress over winter.

Higher reproductive output of the lower Yellowstone population than in that of the Swan was attributed to differences in nutritional plane over winter as apparent from the respective strategies of winter habitat use. The availability of agricultural crops in combination with typically low accumulation of snow on the lower Yellowstone allowed deer to selectively forage and remain in comparatively good condition through winter. Environmental conditions in the Swan Valley during winter favored a habitat use strategy of energy conservation to compensate for relatively low availability of high quality forage.

Differences between areas in patterns of growth and

reproductive success of females suggested that growth of females on the Yellowstone was curtailed as they tend to rear fawns as 2 year-olds, while those in the Swan Valley continue to grow because of not having to commit forage resources to lactation. Additional information was provided by 3 live-trapped females from the lower Yellowstone that were weighed during early winter in 2 consecutive years (1985-1986, Dusek, unpubl. data). All were pregnant during both years. A 2 year-old, that lost her fawn within 4-6 weeks following birth, was 6 kg heavier the following December than she was as a yearling one year earlier. Another 2 year-old, after rearing 2 fawns to at least 4 months, experienced no change in weight during the same period. The third female successfully reared 2 fawns as a 4 year-old and experienced a 6 kg loss in weight from winter to winter.

Energetic costs of reproduction among successful female deer may be reflected in delayed accumulation of body fat, delayed breeding, reduced fecundity, and comparatively high mortality (Mansell 1974, McGinnes and Downing 1977, Clutton-Brock et al. 1983). Short et al. (1969) implied that the energy demand imposed on females by lactation may far outweigh energy demands of gestation. Parturition and onset of lactation coincides with an annual period (late spring-early summer) of rapid body growth in young deer (Short et al. 1969, Bahnak et al. 1981).

Females may more readily commit resources to successful fawn rearing on the lower Yellowstone because agricultural crops provide high energy food sources during pregnancy and lactation. They rapidly accumulate body fat during October and November and maintain their fall weights at least through January (Dusek, unpubl. data). Young adult females in the Swan Valley are in poorer condition during late gestation and fawning and may require a longer period to accumulate sufficient body fat to survive subsequent winters. There, forage resources are less abundant and winters are longer than on the lower Yellowstone. Females that commit resources to lactation may do so at the risk of their own survival.

Mundinger (1981) hypothesized that the dynamics of the Swan Valley population tended toward population stability, and that stability was a response to a comparatively stable habitat. This appears consistent with a principal of inclusive fitness as explained by McCullough (1979) whereby an individual, while initially committing resources to a reproductive effort, may sacrifice the effort in favor of her own continued survival. Alternatively, in habitats where forage resources are high, a submature individual may delay growth in favor of reproductive success.

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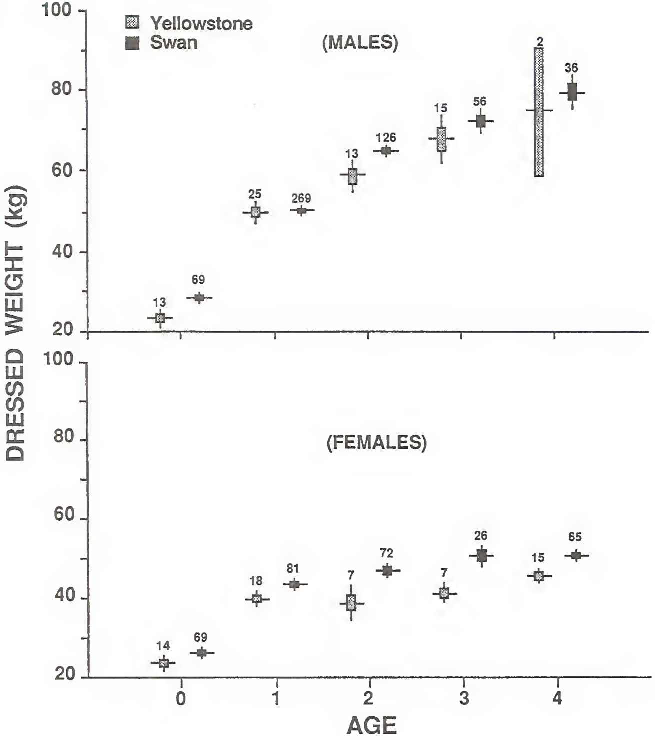

Figure 1. Field-dressed weights of white-tailed deer from the Swan Valley and the lower Yellowstone River by age and sex. Shown is the mean + standard error of the mean (shaded rectangle), the 95% confidence interval (vertical line), and sample size above.